WO 2005/066661 PCT/GB2004/005427

CLAIMS

- 1. Method of determing a digital filter for seismic signals comprising the steps of:
- defining contraints representing a filter for preserving signals representing reflection and/or refractions from subsurface structure and suppressing noise signals in seismic signals; and

using an iterative process with each iteration further 10 comprising the steps of:

- transforming a filter obtained from a previous iteration into a transform domain;
- applying in said transform domain first constraints;
- inverse transforming the filter with the applied
- 15 constraints into a sample domain; and
 - applying in said sample domain second constraints to obtain an iterated filter.
- 2. The method of claim 1 wherein each step of the iterative process includes the transform of the filter (coefficients) into the wavenumber or frequency-wavenumber domain and the inverse transform back into the spatial or temporal-spatial domain.
- 25 3. The method of claim 2 wherein in each step of the iterative process the filter is constrained to a predefined tolerance in the wavenumber or frequency-wavenumber domain.
- 4. The method of claim 2 wherein in each step of the iterative process the filter is constrained to a predefined response outside a finite region in the spatial or temporal-spatial domain.

WO 2005/066661 PCT/GB2004/005427

5. The method of claim 2 wherein in each step of the iterative process the filter is constrained to a predefined response outside a finite region in the spatial or temporal-spatial domain and in each step of the iterative process the filter is constrained to a predefined tolerance in the wavenumber or frequency-wavenumber domain.

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- 6. The method of claim 1 wherein the filter is
 10 obtained by applying alternating projection onto constraints
 defining convex sets of square summable sequences.
- The method of claim 1 wherein the transform sampling/periodicity matrix of the transform in Cartesian
 coordinates is non-diagonal.
 - 8. The method of claim 1, further comprising the step of distributing groups of receivers or single sensor seismic receivers so as to obtain seismic measurements on a staggered or hexagonal grid.
 - 9. The method of claim 8 wherein the step of transforming comprises the use of a spatially staggered or hexagonal transformation.
 - 10. The method of claim 9 wherein the step of transforming the signals comprises the use of a spatially staggered or hexagonal Fourier transformation.
- 30 11. The method of claim 1 wherein the filter is a zerophase finite impulse response (FIR) filter.

WO 2005/066661 PCT/GB2004/005427

12. The method of claim 1 wherein the filter has at least two dimensions.

13. The method of claim 1 wherein the filter is a 3D filter.